March 1949 ET-265

United States Department of Agriculture
Agricultural Research Administration
Bureau of Entomology and Plant Quarantine

# AN APPARATUS FOR RAPIDLY INSPECTING BOTH SIDES OF SMALL OBJECTS

By Gailen D. White
Division of Cereal and Forage Insect Investigations

During an investigation on the control of insects attacking farm-stored grain, it was desired to have a rapid and accurate method for determining the amount of insect damage occurring during the storage period. By the usual method of separating damaged from undamaged kernels it is necessary to turn each kernel in the sample by hand in order to see all parts of it. This is a slow, tedious process when large numbers of 1-ounce samples are being examined.

The apparatus herein described permits rapid examination of a large number of samples with greater precision and with less eye fatigue to the operator than was the case heretofore, since it enables the observer to view both sides of the grain without turning it. Other workers may find this device valuable in making observations of a similiar nature, or might adapt it to suit their particular needs.

## Materials and Construction

A diagrammatic side view showing details of the apparatus is shown in figure 1. The following materials are required for its construction:

G, plate glass, $\frac{1}{4}$ x 9 x 12 inches
M, plate glass mirror, $\frac{1}{4}$ x 9 x 12 inches
MI, plate glass mirror, $\frac{1}{4}$ x 9 x 12 inches
L, reading glass, 5-inch diameter
B, showcase bulb, 25-or 40-watt
S, light socket and switch with cord
P, metal baffle, 22-gage, 4 x 4 inches
N, wooden light obstructor, $\frac{1}{2}$ x 4 x 6 inches
Z, metal lens support, 22-gage, $1\frac{1}{2}$ x 17 inches
R, wood stripping, $\frac{1}{4}$ x $\frac{1}{4}$ x 12 inches, S4S
W, wood stripping (supports), $\frac{1}{2}$ x $\frac{1}{2}$ x 42 inches, S4S
X, felt stripping, $\frac{1}{2}$ x 1/8 x 74 inches
C, cleating, white pine, $\frac{1}{2}$ x $1\frac{1}{2}$ x 72 inches, S4S
Nails, 1-inch box
White pine, one piece, $\frac{1}{2}$ x $12\frac{1}{2}$ x 17 inches, S4S (bottom of box)
Plywood, 4/16-inch, 3-ply: 2 pieces $7\frac{1}{2}$ x 17 inches;
1 piece $7\frac{1}{2}$ x $13\frac{1}{2}$ inches (sides of box)

Construct a box 17 inches long, 12 inches wide, and 7 inches high, inside dimensions, using the plywood described ~~in the~~ above ~~list~~. Leave the back end and top of the box open to allow the flexibility of the sides to assist in holding the adjustable mirror (MI) in place. Make a slot (H), $1\frac{1}{2}$ by 4 inches, $1\frac{1}{2}$ inches below the upper edge and 4 inches from the front end of the left side of the box to provide for the insertion of the showcase lamp (B). Fasten the wood stripping (W below G) for the plate glass support to the inner edge of the box. Place stripping so that when a felt strip (X) is glued to its upper side the surface of the glass placed on top of the felt will be flush with the top edge of the box. Cover the upper surfaces of the diagonal mirror supports (W below M) with felt and place them at a 40-degree angle with the bottom of the box. Make the over-all length of each support $10\frac{1}{2}$ inches, mitering the ends to fit the bottom and end of the box. Tack a strip (R) at the base of these supports, leaving room for the thickness of the mirror (M). Glue felt strips (X) on the sides and bottom of the box as shown in the diagram. Attach the metal heat and light deflector (P) to the wood stripping (W below G) above the lamp slot. Secure the wooden light obstructor (N) to the side of the box with a single screw 2 inches from the bottom (Y) in order that it may be rotated to allow placement of the mirror (M). Cut a strip of metal (Z) and drill a 3/16-inch hole $\frac{1}{2}$ inch from one edge and equidistant from the ends for insertion of the screw portion of the handle of the reading glass (L). Cut the handle of the reading glass to a length of $\frac{1}{2}$ inch and use it as a nut, or substitute a nut for it, to fasten the rim of the lens to the metal strip. Clamp the ends of the metal strip supporting the lens around the cleats on both sides of the box, so that the lens is nearest the glass (G). Drill holes (K) in the box for the light cord, and place the socket so that the lamp is held in place when inserted in the slot (H) from the inside of the box. On the underside of the glass plate (G) as viewed from above, block out with black paint to stop light glare a $3\frac{1}{2}$-inch strip on the left-hand side, rounding it to a 2-inch strip on the side next to the operator, as shown in figure 3. A trough may be added to the right side of the box for convenience in sliding undamaged grain off into a receptacle (fig. 2). A 1-ounce salve tin to receive damaged kernels is placed in a receptacle mounted on the right side of the box (fig. 3).

## Operation

Place a 1-ounce sample of grain on the left side of the glass (fig. 1, G) and with a hockey-stick-shaped spatula spread some of the grain in a single layer in the center of the visual field. This spatula, which is shown in figure 3, may be fashioned from a suitable twig. A reading glass will aid in the examination of the top side of the kernels. It may be held in the hand or mounted on a swivel arm attached to the side of the box. To provide equal lighting for the top and bottom sides of the sample a goose-neck desk lamp may be used. The angle of the mirror (fig. 1, MI) and the distance of the mirror from the lens (L) can be adjusted so that the operator can see the image without changing his position. By looking into the mirror (MI),

the operator can readily see any damage on the bottom side of the kernels. For greatest convenience, the top of the apparatus should be about table height. Use tweezers to remove the damaged kernels. Push the undamaged kernels into the trough, which conveys them to another receptacle.

Examine remainder of the grain sample in the same manner. With a little experience the operator learns how much material can be examined at one time within the limits set by the field of the lens. The bottom view of the grain is magnified, making discernment of damaged kernels easy.

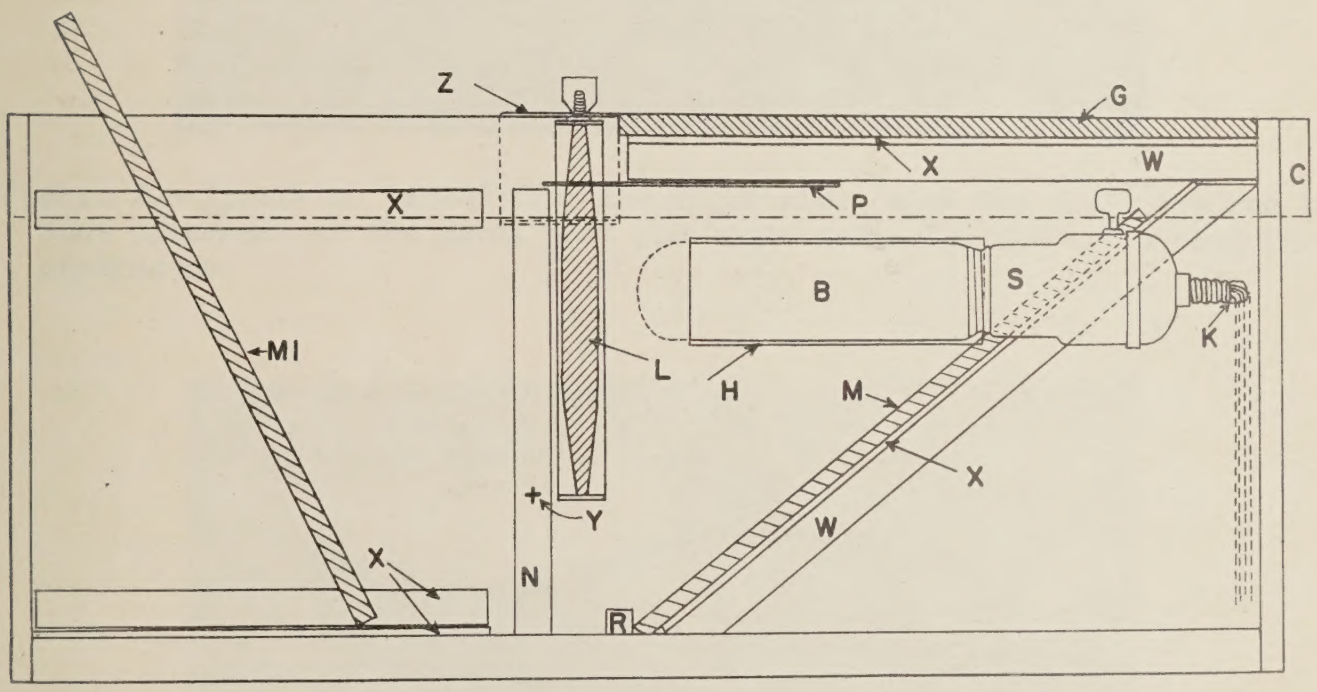


Figure 1.--Diagrammatic side-view of apparatus showing details of construction. See text for explanation of letters.